A new luminescence detection/stimulation head assembly for the Risø TL/OSL reader

Lapp, Torben

Published in:
UK Luminescence and ESR Meeting 2013

Publication date:
2013

A new luminescence detection/stimulation head assembly for the Risø TL/OSL reader

T. Lapp[a] et al. [a,b]

[a]Center for Nuclear Technologies, Technical University of Denmark, Risø Campus, Roskilde, Denmark
[b]Nordic Laboratory for Luminescence Dating, Aarhus University, Risø Campus, Roskilde, Denmark

New attachments are continually being developed for the Risø TL/OSL reader to provide easy research access to new technologies, new signals and new measurement methods. There has long been a wish for the ability to change filter combinations within a measurement sequence, and with the resurgence of interest in feldspar dating this demand has increased. In addition, the continuing growth of interest in single grain dating and the improvements in camera technology offer a new alternative to the existing single grain laser-based system. Here we present a new flexible detector/stimulation head combination with dedicated driver electronics which can be retrospectively fitted to existing Risø platforms. The unit is equipped with up to 3 different photon detectors which can include a UV/blue sensitive photomultiplier, a cooled near-IR photomultiplier and/or an EMCCD based imaging detector. Alternatively the detector head assembly can be replaced by the existing widely-used laser single grain attachment. Stimulation uses blue (470 nm; >100 $mW.cm^{-2}$) green (530 nm; >50 $mW.cm^{-2}$) or near-IR (870 nm; >150 $mW.cm^{-2}$) light, in CW, pulsed or modulated modes; an additional 405 nm 100 mW violet laser source is optional. Any combination of stimulation wavelength and mode can be user-selected within each step in a measurement sequence, together with a choice of 16 possible pairs of filter combinations (achieved through 2 superimposed filter wheels each containing four 25 mm diameter filters). There is also a port and control electronics for attachment of an external stimulation source (or the optional violet laser). A full set of control and analytical software has been developed for automatic processing of photomultiplier data and luminescence images to derive both large aliquot and single grain dose estimates. The overall sensitivity of this assembly in photon-counting mode is comparable with that of the standard Risø reader, and the camera sensitivity is comparable with that of the laser-based single grain system.

All the new photon counting and stimulation facilities will be described, and the performance compared with that of a standard reader. The camera system will also be discussed in more detail in related presentations (Kook et al., Thomsen et al.)

Acknowledgements: The entire research and development group in the Luminescence Research group at Risø has taken part in the definition, design and development of this new generation detection/stimulation head.